MANAGEMENT OF WATERHEMP WITH SOIL-APPLIED FOLLOWED BY POSTEMERGENCE HERBICIDES IN ROUNDUP READY® SUGARBEET AT HERMAN, MN IN 2013

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The objective of this study was to determine the effectiveness of soil-applied followed by postemergence herbicides on control of glyphosate-resistant and -susceptible waterhemp populations and the impact on sugarbeet yield and extractable sucrose.

MATERIALS AND METHODS

Urea fertilizer was applied at 143 lbs/A and incorporated with a Kongskilde 's-tine' field cultivator equipped with rolling baskets on May 10, 2013. 'Crystal 875RR' sugarbeet was seeded 1.25 inches deep in 22 inch rows at 60,825 seeds per acre on May 13. Sugarbeet was treated with Tachigaren and Poncho Beta at 45 grams and 5.07 fl oz of product, respectively, per 100,000 seeds. Counter 15G insecticide at 6 pounds product per acre was applied in a 5-inch band and drag chain incorporated at planting. Herbicide treatments were applied May 13, June 6 & 27, and July 10. All treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO₂ at 40 psi to the center four rows of six row plots 30 feet in length. Preplant-incorporated (PPI) treatments were incorporated 1.5 inches deep with a John Deere 8-foot 's-tine' field cultivator equipped with a spring-tooth harrow. Cercospora leaf spot was controlled with Proline at 5.7 fl oz/A, Inspire XT + Topsin at 7 + 10 fl oz/A, and Headline at 9 fl oz/A broadcast July 18, August 13 and 19, respectively. Sugarbeet was harvested September 18 from the center two rows of each plot and weighed. Twenty to thirty pounds of sugarbeet was collected from each plot and analyzed for quality at American Crystal Sugar Quality Lab, East Grand Forks, MN.

Sugarbeet stand was counted in the center two rows of plots on June 28 and September 18. Sugarbeet injury was evaluated on June 6. Waterhemp control was evaluated on June 6, July 23, and September 5. All evaluations were a visual estimate of percent fresh weight reduction in the four treated rows compared to the adjacent untreated strip. Experimental design was randomized complete block with 4 replications. Data were analyzed with the ANOVA procedure of Agriculture Research Manager, version 8.5.0 software package.

Table 1. Application Information

Application code	A	В	C	D	E
Date	May 13	May 13	June 6	June 27	July 10
Time of Day	3:00 P	4:00 P	12:00 P	9:30 A	11:30 A
Air Temperature (F)	86	86	59	76	76
Relative Humidity (%)	29	29	58	45	56
Wind Velocity (mph)	5	5	6	10	3
Wind Direction	WSW	WSW	N	NW	NW
Soil Temp. (F at 6")	57	57	55	75	71
Soil Moisture	Fair	Fair	Good	Good	Good
Cloud Cover	50	50	100	5	40
Sugarbeet stage (avg)	PPI	PRE	cot-2 lf	12 lf	16 lf

SUMMARY

Three applications of Roundup PowerMax (glyphosate; 4.5 lbae/gal) gave 88% waterhemp control at the September 5 evaluation. This level of control indicates the presence of some glyphosate resistant waterhemp. The addition of Betamix (desmedipham + phenmedipham; 0.65 + 0.65 lbai/gal), Ethofumesate 4SC (ethofumesate; 4 lbai/gal), and Destiny HC (a high surfactant methylated seed oil concentrate) to glyphosate increased waterhemp control to 95%. The addition of Outlook to the PowerMax+Ethofumesate+Betamix tank-mix did not significantly improve waterhemp control. Outlook was applied too late in the growing season to provide a measurable benefit. Outlook must be applied prior to waterhemp emergence. The application of a soil herbicide, regardless of rate tested, followed by three PowerMax applications gave 98% to 100% waterhemp control. Timely rains allowed for excellent herbicide activation and reduced rates of preemergence or pre-plant incorporated herbicide gave waterhemp control similar to full rates. In drier conditions it is questionable if reduced rates of these soil-applied herbicides would perform as well as the full rates.

No significant sugarbeet injury was observed by any herbicide treatments throughout the season. No difference was observed in sugarbeet stand at either date evaluated. Sugarbeet treated with herbicide did show significantly greater yield and extractable

sucrose per acre compared to the untreated check. There were some differences in yield and extractable sucrose among herbicide treatments, but it is uncertain as to what caused these differences. These differences appear random and may be caused by soil and environmental variability rather than from weed competition or herbicide injury.

Table 2. Management of Waterhemp with Soil-Applied Followed by Postemergence Herbicides in Roundup Ready \otimes Sugarbeet – Herman, MN – 2013 (Carlson).

Test													
	Treatment	Rate	Appl	sgbt	colq	wahe	wahe	wahe	sgbt	sbgt	sgbt	sgbt	sgbt
No	Name	Rate Unit	Code	Inj	cntl	cntl	cntl	cntl	stand	stand	yield	sucr	ext su
			~			%			no./1		ton/a	%	lb/a
1	RU PowerMax	32 / 24 / 22 fl oz/a		0	0	0	92	88	215	208	26.3	16.8	8184
	N Pak AMS	2.5 % v/v											
	NIS	0.25 % v/v											
	RU PowerMax	32 / 24 / 22 fl oz/a		0	0	0	94	87	228	221	27.5	16.3	8302
	Ethofumesate	4 fl oz/a											
	N Pak AMS	2.5 % v/v											
	Destiny HC	1.5 pt/a	CDE										
3	RU PowerMax	32 / 24 / 22 fl oz/a		0	0	0	98	95	223	222	24.7	17.0	7747
	Betamix	10 / 16 / 24 fl oz/a											
	Ethofumesate	4 fl oz/a											
	N Pak AMS	2.5 % v/v	CDE										
	Destiny HC	1.5 pt/a	CDE										
1	RU PowerMax	32 / 24 / 22 fl oz/a	C/D/E	0	0	0	99	97	215	220	22.9	16.9	7145
	Betamix	10 / 16 / 24 fl oz/a	C/D/E										
	Outlook	21 fl oz/a	D										
	Ethofumesate	4 fl oz/a	CDE										
	N Pak AMS	2.5 % v/v	CDE										
	Destiny HC	1.5 pt/a	CDE										
5	Ro-Neet SB	3.6 pt/a	A	0	90	78	99	98	225	216	27.8	17.0	8744
	RU PowerMax	32 / 24 / 22 fl oz/a	C/D/E										
	N Pak AMS	2.5 % v/v	CDE										
	NIS	0.25 % v/v	CDE										
	Ro-Neet SB	3.6 pt/a	A	1	83	83	100	99	224	212	26.5	16.8	8217
	RU PowerMax	32 / 24 / 22 fl oz/a	C/D/E										
	Ethofumesate	4 fl oz/a	CDE										
	N Pak AMS	2.5 % v/v											
	Destiny HC	1.5 pt/a	CDE										
7	Ro-Neet SB	3.6 pt/a	A	0	53	70	100	100	225	214	23.3	16.8	7296
	RU PowerMax	32 / 24 / 22 fl oz/a											
	Betamix	10 / 16 / 24 fl oz/a											
	Ethofumesate	4 fl oz/a											
	N Pak AMS	2.5 % v/v											
	Destiny HC	1.5 pt/a	CDE										
8	Ro-Neet SB	3.6 pt/a	A	0	88	90	100	100	226	208	26.2	16.7	8093
	RU PowerMax	32 / 24 / 22 fl oz/a		-									
	Betamix	10 / 16 / 24 fl oz/a											
	Outlook	21 fl oz/a											
	Ethofumesate	4 fl oz/a											
	N Pak AMS	2.5 % v/v											
	Destiny HC	1.5 pt/a	CDE										
)	Ro-Neet SB	5.3 pt/a	A	1	95	95	98	99	222	214	24.6	17.1	7783
	RU PowerMax	32 / 24 / 22 fl oz/a		•									
	N Pak AMS	2.5 % v/v											
	NIS	0.25 % v/v											
10	Ro-Neet SB	5.3 pt/a	A	1	88	90	100	100	232	214	26.7	16.7	8285
- 0	RU PowerMax	32 / 24 / 22 fl oz/a		•	00	70	100	100	232	21-1	20.7	10.7	0203
	Ethofumesate	4 fl oz/a											
	Lanorantesate												
	N Pak AMS	2.5 % v/v	CDE										

 $\label{thm:conditional} Table~2.~Management~of~Waterhemp~with~Soil-Applied~Followed~by~Postemergence~Herbicides~in~Roundup~Ready @ Sugarbeet~Herman,~MN~2013~(Carlson).$

Sugarbeet – Herm	an, MN – 2013 (Ca	rison).		June 6		July 23	Sept 5	June 28		Septe	mber 18	
Trt Treatment	Rate	Appl	sgbt	colq	wahe	wahe	wahe	sgbt	sbgt	sgbt	sgbt	sgbt
No Name	Rate Unit	Code	Ĭnj	cntl	cntl	cntl	cntl	stand	stand	yield	sucr	ext suc
					%			no./10		ton/a	%	lb/a
11 Ro-Neet SB	5.3 pt/a	A C/D/E	3	93	98	100	100	216	216	26.3	16.5	8023
RU PowerMax	32 / 24 / 22 fl oz/a 10 / 16 / 24 fl oz/a											
Betamix Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
Destiny HC	1.5 pt/a	CDE										
12 Ro-Neet SB	5.3 pt/a	A	3	90	85	100	100	230	205	26.5	17.0	8385
RU PowerMax	32 / 24 / 22 fl oz/a											
Betamix	10 / 16 / 24 fl oz/a											
Outlook	21 fl oz/a											
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v	CDE										
Destiny HC 13 Dual Magnum	1.5 pt/a 1 pt/a	В	1	100	100	100	100	224	217	25.9	16.8	8055
RU PowerMax	32 / 24 / 22 fl oz/a		1	100	100	100	100	224	217	23.9	10.6	8033
N Pak AMS	2.5 % v/v											
NIS	0.25 % v/v											
14 Dual Magnum	1 pt/a	В	0	75	88	100	100	229	212	23.6	17.5	7686
RU PowerMax	32 / 24 / 22 fl oz/a	C/D/E										
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
Destiny HC	1.5 pt/a	CDE		0.5	100	100	100	222	017	24.1	160	7000
15 Dual Magnum	1 pt/a 32 / 24 / 22 fl oz/a	B C/D/E	1	95	100	100	100	232	217	24.1	16.8	7900
RU PowerMax Betamix	32 / 24 / 22 fl 02/a 10 / 16 / 24 fl 0z/a											
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
Destiny HC	1.5 pt/a	CDE										
16 Dual Magnum	1 pt/a	В	1	88	100	100	100	217	213	26.7	16.7	8262
RU PowerMax	32 / 24 / 22 fl oz/a											
Betamix	10 / 16 / 24 fl oz/a											
Outlook	21 fl oz/a											
Ethofumesate N Pak AMS	4 fl oz/a 2.5 % v/v											
Destiny HC	2.5 % V/V 1.5 pt/a	CDE										
17 Dual Magnum	1.5 pt/a	В	1	100	100	100	100	213	204	28.3	16.9	8816
RU PowerMax	32 / 24 / 22 fl oz/a		1	100	100	100	100	213	201	20.3	10.7	0010
N Pak AMS	2.5 % v/v											
NIS	0.25 % v/v	CDE										
18 Dual Magnum	1.5 pt/a	В	0	85	100	100	100	212	206	27.0	16.5	8262
RU PowerMax	32 / 24 / 22 fl oz/a											
Ethofumesate	4 fl oz/a											
N Pak AMS Destiny HC	2.5 % v/v 1.5 pt/a	CDE										
19 Dual Magnum	1.5 pt/a	В	0	100	100	100	100	216	210	26.1	16.3	7854
RU PowerMax	32 / 24 / 22 fl oz/a		U	100	100	100	100	210	210	20.1	10.5	7054
Betamix	10 / 16 / 24 fl oz/a											
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v	CDE										
Destiny HC	1.5 pt/a	CDE										
20 Dual Magnum	1.5 pt/a	В	4	90	100	100	100	223	204	24.1	16.8	7515
RU PowerMax	32 / 24 / 22 fl oz/a											
Betamix	10 / 16 / 24 fl oz/a											
Outlook Ethofumesate	21 fl oz/a 4 fl oz/a											
N Pak AMS	2.5 % v/v											
IVI UK / HVID	2.5 /0 V/V	CDL										

 $\label{thm:conditional} Table~2.~Management~of~Waterhemp~with~Soil-Applied~Followed~by~Postemergence~Herbicides~in~Roundup~Ready @ Sugarbeet~Herman,~MN~2013~(Carlson).$

			June 6		July 23	Sept 5	June 28		September 18		1	
Trt Treatment	Rate	Appl	sgbt	colq	wahe	wahe	wahe	sgbt	sbgt	sgbt	sgbt	sgbt
No Name	Rate Unit	Code	Inj	cntl	cntl	cntl	cntl	stand	stand	yield	sucr	ext suc
					%			no./1	00 ft	ton/a	%	lb/a
Destiny HC	1.5 pt/a	CDE				100		22.5	215	2 . 7	1.50	00.11
21 Ethofumesate	5 pt/a	A	1	73	75	100	99	225	217	26.7	16.9	8341
RU PowerMax	32 / 24 / 22 fl oz/a											
N Pak AMS	2.5 % v/v											
NIS	0.25 % v/v			0.7	0.0	100	100	220	21.5	266	1.60	0070
22 Ethofumesate	5 pt/a	A	1	95	98	100	100	228	215	26.6	16.8	8279
RU PowerMax	32 / 24 / 22 fl oz/a											
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
Destiny HC	1.5 pt/a	CDE		7 0		100	100	215	212	25.0	1.60	0011
23 Ethofumesate	5 pt/a	A	1	50	75	100	100	217	212	27.8	16.2	8311
RU PowerMax	32 / 24 / 22 fl oz/a											
Betamix	10 / 16 / 24 fl oz/a											
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
Destiny HC	1.5 pt/a	CDE			0.4	100	100	221	216	212	15.0	
24 Ethofumesate	5 pt/a	A	0	89	84	100	100	221	216	24.3	17.0	7717
RU PowerMax	32 / 24 / 22 fl oz/a											
Betamix	10 / 16 / 24 fl oz/a											
Outlook	21 fl oz/a											
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
Destiny HC	1.5 pt/a	CDE	1	C 0	00	100	100	222	215	25.6	165	77.61
25 Ethofumesate	7.5 pt/a	A C/D/E	1	68	98	100	100	222	215	25.6	16.5	7761
RU PowerMax	32 / 24 / 22 fl oz/a											
N Pak AMS	2.5 % v/v											
NIS	0.25 % v/v		Λ	100	100	100	100	221	214	27.0	16.0	9467
26 Ethofumesate RU PowerMax	7.5 pt/a 32 / 24 / 22 fl oz/a	A C/D/E	0	100	100	100	100	221	214	27.0	16.9	8467
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
	2.5 % V/V 1.5 pt/a	CDE										
Destiny HC 27 Ethofumesate	7.5 pt/a		0	93	100	100	100	231	215	25.1	17.3	8061
RU PowerMax	7.5 pt/a 32 / 24 / 22 fl oz/a	A C/D/F	U	73	100	100	100	231	213	23.1	17.3	6001
Betamix	32 / 24 / 22 ft 02/a 10 / 16 / 24 ft 0z/a											
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
Destiny HC	1.5 pt/a	CDE										
28 Ethofumesate	7.5 pt/a	A	0	93	98	100	100	227	217	27.1	16.7	8331
RU PowerMax	32 / 24 / 22 fl oz/a		U)3	70	100	100	221	41/	4/.1	10.7	0331
Betamix	10 / 16 / 24 fl oz/a											
Outlook	21 fl oz/a											
Ethofumesate	4 fl oz/a											
N Pak AMS	2.5 % v/v											
Destiny HC	1.5 pt/a	CDE										
29 Untreated Check			0	0	0	0	0	215	185	15.7	16.8	4892
2) Onifolica Check	LSD 5	10 / ₀	NS	32.7	25.0	3.0	4.2	NS	NS	5.01	NS	1378